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# Toxic Pesticide Drift- A Study of 20 Cases

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**Abstract:** ***This study of 20 cases of accidental organophosphates poisoning while spraying pesticide, is an observational study of conse cutive such cases that were admitted under General Medicine units of our tertiary care Government hospital over 5 months.95% patients had a mild to moderate form of illness from which they recovered. One patient however succumbed. The common factors were that (i) n one of the patients had worn proper protective gear and (ii) all the patients developed toxic effects of the pesticide spray while spraying B T cotton plants, that were almost as tall as themselves. While spraying the tops of these plants, the spray may have directly drifted on to t he face of the farmer due to wind. Airborne movement of a pesticide to unintended targets is called pesticide drift. This can pollute soil, water and crops. The immediate adverse result is, toxic effects on the person who is spraying the pesticide.***

**Keywords-** Pesticide drift, organophosphates, insecticide spraying.

## 1. Introduction

A pesticide is any substance or a mixture of substances inten ded for preventing, destroying, repelling or mitigating any p est. Pesticides are chemical or biological substances widely used in agricultural production to control pests, disease, wee ds etc. They reduce disease and maintain high quality of the product[1].

A wide range of products-insecticides, herbicides, rodenticid es, molluscicides, nematocides ,even plant growth regulators are included in this category. Organophosphates were introd uced in the 1960s and carbamates in the 1970s. In India, the production of pesticides began in 1952 and is now the secon d highest manufacturer in Asia(after China) and 12$^{th}$ globally .45% of the use is for cotton, followed by paddy and wheat[ 2].

Natural plant derived or biologically based pesticides like ne em oil, pyrethrum daisy, pheromones and microbes are safer [1].
However, organophosphates are probably the commonest pe sticides to be used in India and definitely in the state of Mah arashtra. Poisoning with these substances is one of the comm onest problem that we face in the ICU-It is mostly a suicidal attempt. 76% of pesticides in India are insecticides, as again st 44% globally[2]. However, we do see cases of accidental poisoning too…by the oral route, or while spraying in the fie ld.

Mechanism of action of organophosphates-

The enzyme cholinesterase, located at nerve terminals ,norm ally hydrolyses acetylcholine. The organophosphates phosph orylate cholinesterase; hence it cannot hydrolyse acetylcholi ne, which accumulates at the receptors producing nicotinic a nd muscarinic signs. Muscarinic effects like meiosis, diarrhe a, vomiting, sweating, bronchial secretions can be countered by atropine (or glycopyrolate)[4].

Nicotinic signs do not respond to atropine and if neuroparaly sis leading to respiratory muscle paralysis occurs, artificial v entilation is the only remedy. Oximes like P2AM displace th e organophosphates from acetylcholine esterases and bind to the enzyme. They then dissociate and reactivate cholinester ase. P2AM works best in the first 36-48 hours and best given as bolus doses.

Pesticides should be effective, cost effective and safe for the operator and the environment. The safety factor is often lack ing due to the non judicious, excessive or careless use of pes ticides.

In the EU-FAO IPM programme for the cotton growers in so uthern India, the effect of pesticides was studied on farmers with the help of self assessment forms. They were earlier tol d about the toxic effects of pesticides and assessed after they had been handling pesticides for few weeks. Of the 323 far mers studied in 4 months, 16.4% were asymptomatic, 39% h ad mild, 38% had moderate and 6% had severe features of p oisoning.

## 2. Study-

This is an observational study of 20 consecutive cases who were admitted to the Medicine wards during July 2016 to No vember 2016 (5 months) due to toxic effects of organophosp hates while spraying.

All cases were medico-legal, history was recorded in detail, either from the patient or from accompanying persons, about the victim's education, the pump used, protective measures


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taken, weather conditions, type of crop and approximate hei ght of plants ,especially in relation to the victim's height and this awareness about safety measures. There were no exclus ion criteria. All patients/caregivers consented to be part of th e study.

**Table 1:** Age of patients

| *Age groups* | *Number of Patients (Percentage %)* |
|---|---|
| 17-20 Years | 5 (25%) |
| 21-30 Years | 5 (25%) |
| 31-40 Years | 7 (35%) |
| 41-50 Years | 3 (15%) |
| Total | 20 (100%) |

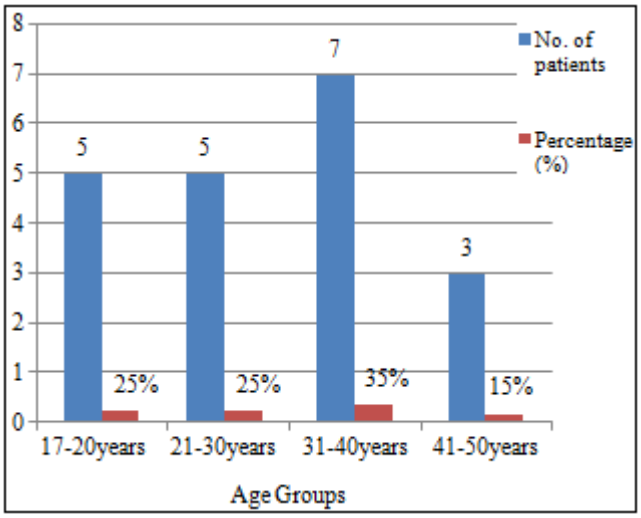


**Table 2:** Sex Wise Distribution of Patients

| Sex of the Patient | Number of Patients (Percentage%) |
|---|---|
| Male | 20 (100%) |
| Female | 0 (0%) |
| Total | 20 (100%) |

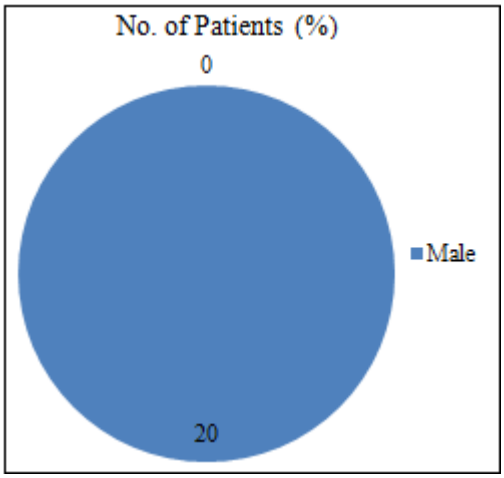


**Table 3:** Education level of the Patients:

| Level of Education | Number of Patients (Percentage%) |
|---|---|
| Illiterate | 3 (15%) |
| School Dropouts | 13 (65%) |
| SSC | 2 (10%) |
| Studying in college | 2 (10%) |
| Total | 20 (100%) |

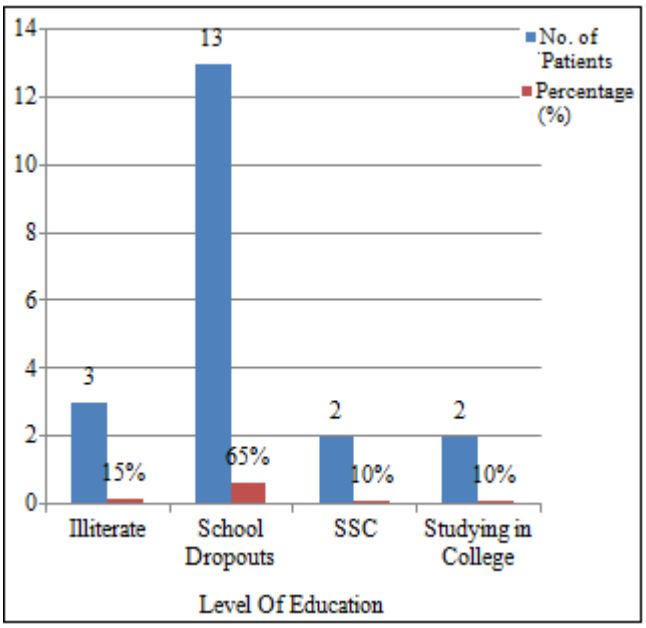


**Table 4:** Distribution according to the type of Plants sprayed

| Type of Plant Sprayed | Number of Patients (Percentage%) |
|---|---|
| BT Cotton | 19 (95%) |
| Sugarcane | 1 (5%) |
| Total | 20 (100%) |

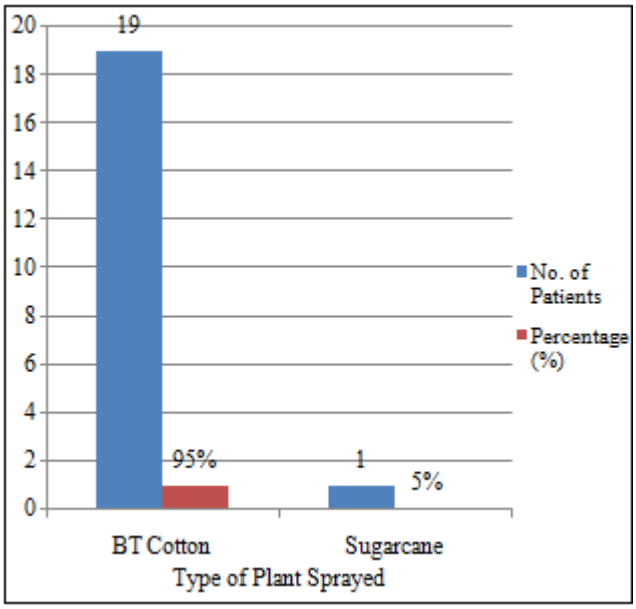


**Table 5:** Symptoms wise distribution:

| Sr.no | Symptoms | No. of Patients (%) |
|---|---|---|
| 1 | Nausea Vomiting | 8 (40%) |
| 2 | Dizziness | 6 (30%) |
| 3 | Abdominal pain | 4 (20%) |
| 4 | Burning of skin | 4 (20%) |
| 5 | Headache | 3 (15%) |
| 6 | Irritation of throat | 3 (15%) |
| 7 | Redness of skin | 3 (15%) |
| 8 | Facial puffiness | 1 (5%) |
| 9 | Diarrhoea | 1 (5%) |


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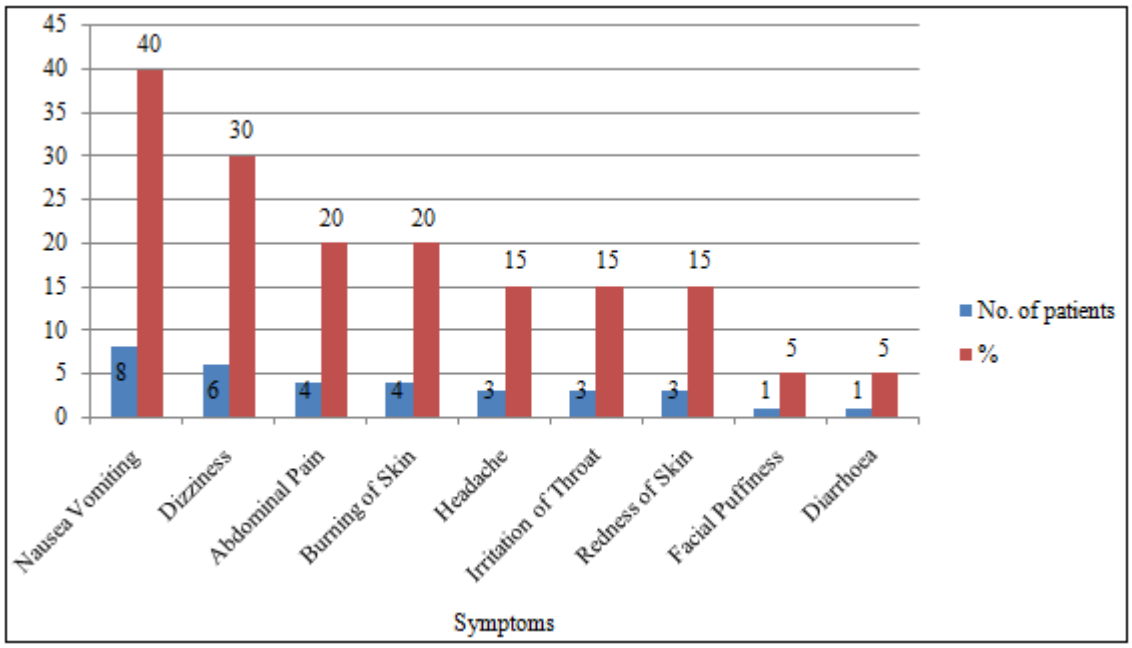


**Table 6:** Level of Consciousness

| Level of Consciousness | No. of Patients (Percentage%) |
|---|---|
| Conscious | 15 (75%) |
| Drowsy | 4 (20%) |
| Unconscious | 1 (5%) |
| Total | 20 (100%) |

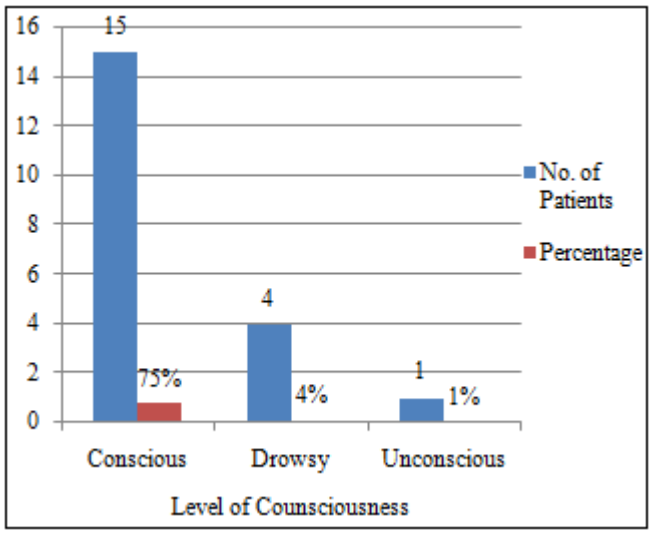


**Table 7:** Distribution of patients according to the condition of pupils at the time of presentation

| Condition of pupils | Number of Patients (Percentage%) |
|---|---|
| Normal | 5 (25%) |
| Constricted | 15 (75%) |
| Total | 20 (100%) |

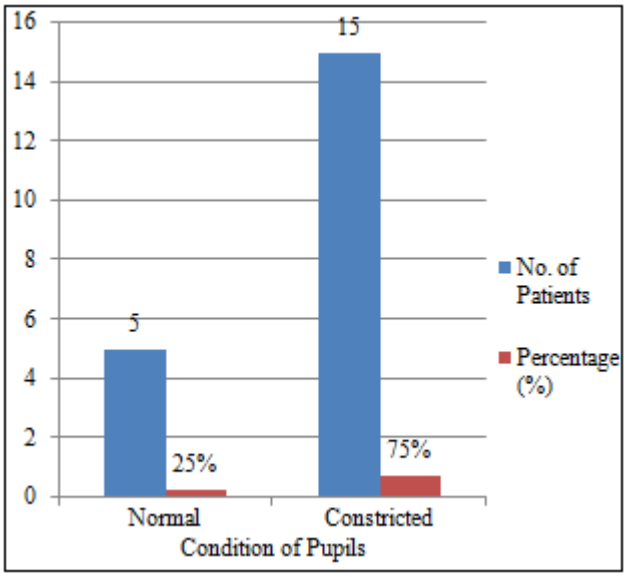


**Table 8:** Distribution of patients according to the presence o f fasciculations

| Fasciculations | No. of Patients (Percentage%) |
|---|---|
| Present | 9 (45%) |
| Absent | 11 (55%) |
| Total | 20 (100%) |


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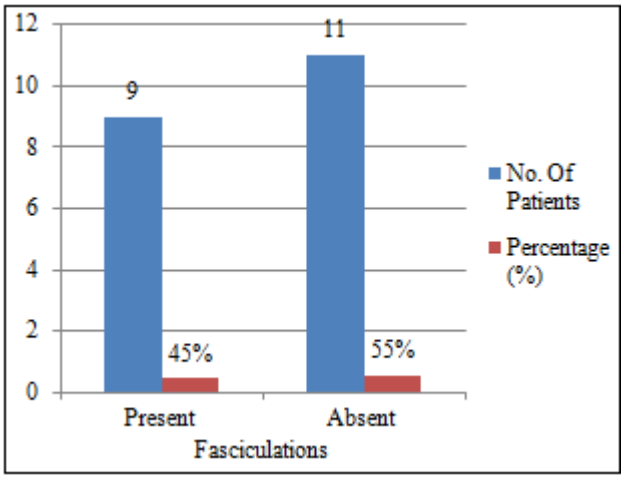


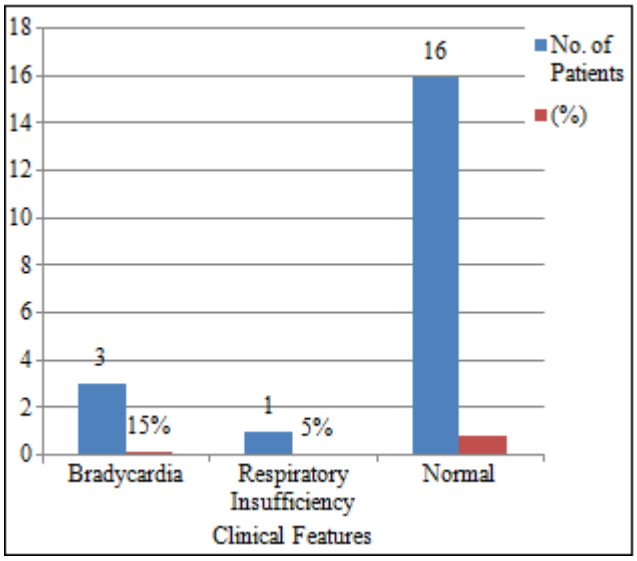




**Table 9:** Distribution of patients according to Clinical Features -

| Clinical Features | Number of Patients (Percentage%) |
|---|---|
| Bradycardia | 3 (15%) |
| Respiratory Insufficiency | 1 (5%) |
| Normal | 16 (80%) |
| Total | 20 (100%) |

**Table 10:** Distribution of patients according to the duration of hospital stay-

| No. of Days in Hospital | No. of Patients (Percentage) |
|---|---|
| 1 | 0 (0%) |
| 2 | 9 (45%) |
| 3 | 2 (10%) |
| 4 | 5 (25%) |
| 5 | 0 (0%) |
| 6 | 0 (0%) |
| 7 | 2 (10%) |
| 8 | 0 (0%) |
| 9 | 2 (10%) |

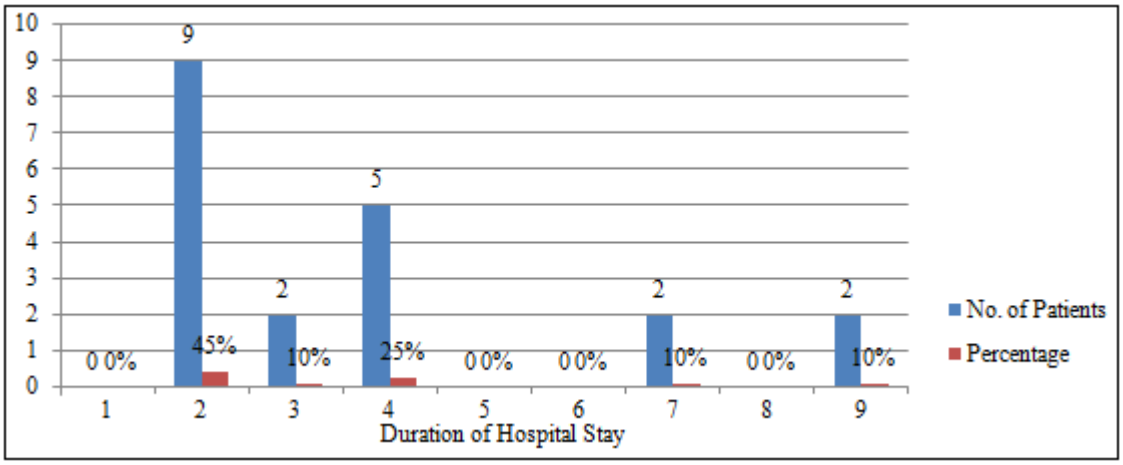
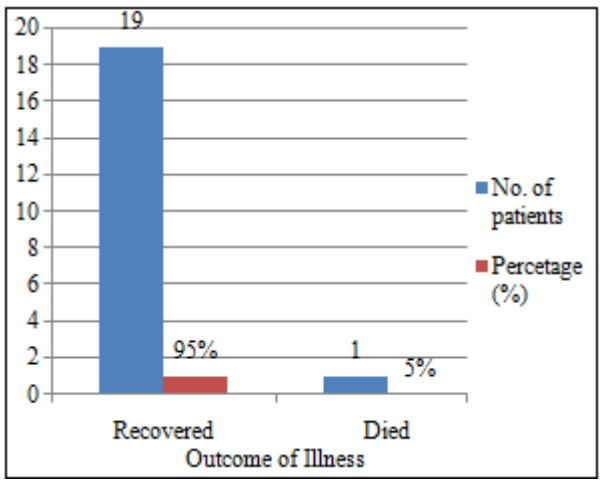



**Table 11:** Distribution of Patients according to the outcome

| Outcome | No. of Patients (Percentage%) |
|---|---|
| Recovered | 19 (95%) |
| Died | 1 (5%) |
| Total | 20 (100%) |





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## 3. Discussion

Pesticide drift is the airborne movement of pesticides from a n area of application to any unintended site.It can happen if droplets or dry dust move away from the target(particle drift ) or if chemicals are converted to vapor(vapor drift).A drift c an harm the person who is spraying(operator) or can have m ore distant effects…when planes or tractors are used for spra ying ,the drift can travel many kilometers[3].

The pesticide may be inhaled by the person(s) who come in t he range of the drift or may be inhaled by the exposed skin o r mucous membranes(conjunctiva, mouth, nose). The drift m ay cause contamination of grains and food articles, soil, wate r and also leads to a lot of wastage of the pesticide. Environ mental factors like temperature, humidity and most importan t, winds, play an important role in causing a drift. Faulty equ ipment and careless use play an important role at individual l evels[4].

In developing countries, farmers face an increased risk beca use they may be still using toxic chemicals that may be bann ed by or restricted by other developed countries ,application techniques may be faulty, inappropriate equipment or that w hich is poorly maintained may be used or legislation for safe use, though it exists ,may not be implemented. Air temperat ure and humidity affect the volatility of some products, pers piration rate and use of personal protective clothes, shoes, gl oves, masks etc. Wind obviously increases pesticide drift. If the operator is spraying against the wind, chances of drift to wards his body are more.

If the plants are naturally short or younger, the drift may not hit his face. But if they are tall. as can happen with sugarcan e or BT cotton, the drift may produce toxic effects due to the exposure of the face. LD50 by the oral route is less than that absorbed through the skin and pesticides enter the blood stre am more easily by the oral route than dermal, but toxicity de pends on the pesticide and its dose [3].

Severity of toxicity due to pesticide spraying depends upon:-

1. Pesticide Toxicity-
WHO CLASS 1A- Extremely hazardous.
WHO CLASS 1B- Highly hazardous.
WHO CLASS 2- Moderately hazardous.
WHO CLASS 3- Slightly hazardous.
WHO CLASS U- Unlikely to present acute hazard[6].

2. Exposure Time- the more the exposure time greater will b e the risk.

3. Volume of spraying solution in litres- higher the volume h igher the risk.

4. Operation- activity performed during working session- wh at the patient was doing while he got exposed to the toxin.

5. Profession- employed/own field- employed individuals re main in contact with the poison for more time than the owne rs of the field.

This study reviews the clinical features and outcome of 20 c ases of accidental poisoning while spraying crops with organ ophosphate compounds:

The youngest patient was 17 years old, oldest (2 )were 50 ye ars of age(of whom 1 died) .Average age-29.8years. Maxim um patients (85%)were in the age group 17-40. All the 20 ca ses were males, because in this region of Marathwada, spray ing of insecticides is almost exclusively done by males. Non e of the educated individuals had agricultural education. 16 were working in their own farm,4 were employed by other f arm owners. All the patients developed toxic effects while sp raying plants that were almost as tall as they were.

95% of the crops were of cotton(BT cotton),that grow tall. In 2016, the rainfall was particularly abundant and the growth of crops was more exuberant.In all the cases, the crops were minimally of the height of their chins. Average height of vict ims…5'6"(165cm), least 5'3",Maximum 6'2''. Estimated he ight of crop(approximate ,from history, patients or relatives s howed approximate height of plant in relation to the patient' s face). In 12 cases, the crops were about 6 to 8 inches above the patient's hea, in 8 cases, they were at face level.

In majority of cases, spraying was carried out just before or after rains .All said that there was a breeze, though not stron g winds. They said that they avoided spraying if there was a strong wind because the spray does not go in the right directi on.2 positively accepted that the breeze was in the opposite direction.

The pumps used were strapped on the back or hand held, ope rated manually or with fuel like diesel or with chargeable bat teries. Except for 2 persons who wore masks, no one had wo rn any protective equipment. Though their body was covered , their face and forearms, hands were exposed. Majority wer e not aware about protective gear or did not have it. They we re very casual about it.

None of the patients had any prior associated co-morbid con ditions. Amongst the symptoms with which the patients pres ente, nausea vomiting was the commonest one occurring in 8 (40%) patients while facial puffiness and diarrhea were leas t common

Other feature which occurred were dizziness (30%), abdomi nal pain (20%), burning of skin (20%), headache (15%), irrit ation of throat (15%) and redness of skin (15%). On examin ation 15 (75%) patients were conscious, 4 (20%) were drows y and 1 (5%) was found to be unconscious. 15 (75%) patient s had constricted pupils whereas 5 ( 25%) had normal sized pupils on presentation. Fasciculations were present among 9 (45%) patients; while the rest 11 ( 55%) had no fasciculation s. 1 (5%) of them had respiratory insufficiency while 3 (15% ) had bradycardia.

Among the 19 patients who survived 9 (45%) were admitted in the hospital for 2 days, 4 (20%) were admitted for 4 days while 2 (10%) were admitted for 3 days, 7 days and 9 days e ach. The 1 (5%) who died was in the hospital for 4 days. 3 p atients had required ventilator support out of which 2 (10%) survived and 1(5%) died.


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## 4. Summary and Conclusions

Drift of pesticides while spraying is common and can lead to serious consequences, even death.

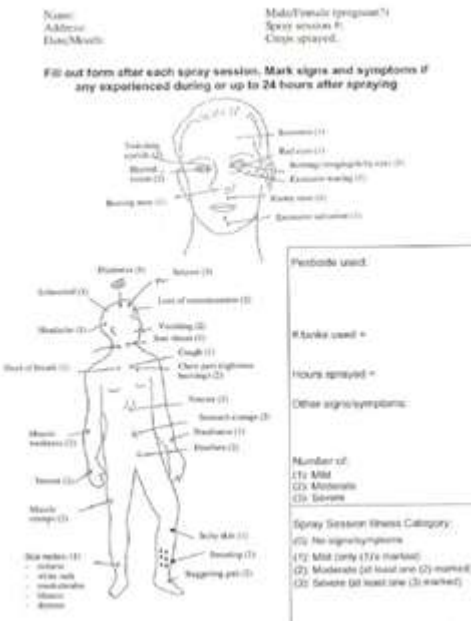
Precautions to be taken while spraying:

1) Be careful while preparing the solution and filling the pu mp. Check the nozzle beforehand. Larger size of droplets may make them drift less as they settle down more easil y.
2) Wear proper protective gear like mask, cap, gloves. Clea n polythene bags may be used to cover the scalp and han ds. Use a handkerchief or towel, or a clean cloth to cover the mouth and nose and use sunglasses to cover the eyes.
3) Avoid hot sunny days, strong windy or foggy weather an d just before or after rains.
4) Do not spray against the wind.
5) Keep the wand or hose of the pump close to the target.
6) See that people around are aware that pesticides are bein g sprayed.
7) Learn the proper technique before you start spraying and see that the equipment is appropriate and well-maintaine d.

**Pic. 1:** Preparation for spraying

**Pic.2:** Young cotton plants

**Pic 3:** Grown up plants (taller than the farmer)




**Pic 4:** Farmers 'Self-Surveillance of Pesticide poisoning: A 12 –month pilot in northen Vietnam'. Murphy HH, Hoan NP

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